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Patterns of common osseous spine tumors on MRI

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Abstract

In the spine, where the red marrow fraction remains relatively large throughout life, marrow signal intensity will be lower than in locations where little red marrow remains (distal appendicular skeleton). This was a prospective study of 42 cases with clinical suspicion of osseous spine tumors who had undergone Magnetic Resonance Imaging. The study was conducted in the Department of Radiodiagnosis & Imaging. In this study, out of 9 cases of vertebral haemangiomas, four cases were between 51 — 60 years of age groups (44.4%) and 3 cases were in 41 — 50 years of age groups (33.3%). Four cases were located in the lumbar region (44.4%) and 3 cases were in thoracic region (33.3%) According to Fox MW *et al.* the peak incidence of vertebral haemangiomas is in fourth to sixth decades. The lower thoracic and lumbar regions are the most common sites for vertebral haemangiomas.

Keywords: Vertebral haemangiomas, osseous spine tumors, MRI

Introduction

The MR appearances of marrow in any particular bone reflects a combined effect of the relative fractions of red marrow, yellow marrow and trabecular bone. On T1 weighted images, yellow marrow exhibits a signal intensity that is roughly similar to that of subcutaneous fat. Normal red marrow is hypointense combined with yellow marrow, although its signal intensity is still greater than that of muscle. On T2 weighted images, the signal intensity of marrow remains greater than that of muscle, while signal differences between red and yellow marrow become less apparent.

In the spine, where the red marrow fraction remains relatively large throughout life, marrow signal intensity will be lower than in locations where little red marrow remains (distal appendicular skeleton) ^[1, 2].

Measured T1 relaxation times of vertebral bodies demonstrate longer T1 values. As the fractional volume of vertebral haematopoietic marrow decreases with age (while the fat fraction increases), T1 relaxation times for vertebral bodies decline, This decrease is most pronounced in the first 4 decades of life. Later, reduction in the mineral content of vertebral bodies (by approximately 40% in men and 55% in women by age 75) probably contributes to alteration in relaxation time. T2 relaxation times show a similar decline with age ^[3].

As conversion of red to yellow marrow occurs in the spine, yellow marrow may replace red marrow in a more focal (rather than diffuse) pattern, resulting in a spotty appearance (bright spots on T2 images) of the bone marrow. These areas of focal conversion to fat are more evident in the posterior elements and at the periphery of vertebral bodies and end plates. This phenomenon is presumed to be a reflection of diminished vascularity in these regions prompting the red to yellow marrow conversion. Focal fatty infiltration increases with age and has an overall prevalence approaching 60% ^[4].

Daffner *et al.* reported that areas of abnormal bone marrow showed low signal intensity. Zimmer *et al.* concluded that MR imaging has a high sensitivity but does not enable distinction to be made between benign and malignant tumors on the basis of signal intensity alone. The prolonged T1 in malignant tumors is well known to be caused by the higher ratio of free water to fixed water than in normal tissues ^[5].

Scattered trials regarding use of gadolinium in spine appeared from Europe and Japan in mid 1980s. The first patient to receive gadolinium specifically for examination of spine pathology was not studied in the United States until late December 1986 ^[6].

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Methodology:

In the case of a patient with clinical suspicion of osseous spine tumor, a complete clinical history with special reference to neurological symptoms was taken, followed by general physical examination and detailed central nervous system examination. Other systems were also examined and findings were noted. Next, the procedure for MRI was explained to the patient and consent was taken.

A detailed history pertaining to the contraindications to MRI was taken. Ear plugs were provided to the patient to minimise noise within the gantry. The patient was then placed in supine position with head first inside the gantry. Proper positioning and immobilisation was done.

This was a prospective study of 42 cases with clinical suspicion of osseous spine tumors who had undergone Magnetic Resonance Imaging. The study was conducted in the Department of Radiodiagnosis & Imaging.

This study used the MRI machine "SIGNA CONTOUR" (General Electric, USA).

It possesses a super conducting K4 magnet with a magnetic field strength of 0.5 Tesla.

Coils used: Phased array Cervical,- Thoracic, Lumbosacral Coronal localiser was obtained first. Then, from this coronal localiser, sagittal localiser was obtained. This was done to apply saturation pulse anterior to the vertebral column to reduce motion artefacts.

Results

Table 1: Clinical symptoms on presentation

Symptoms	No. of cases	Percentage
Backache	31	73.80%
Paraparesis	16	38.09%
Sciatica	24	57.14%
Sphincter disturbance		7.14%
Paraesthesia	7	16.67%
Headache	1	2.38%

Low backache was the most frequent presenting symptom.

Table 2: Tumors of osseous spine

Symptoms	No. of cases	Percentage
Metastasis	22	52.38%
Haemangioma	9	21.44%
Multiple myeloma	5	11.90%
Chondrosarcoma	2	4.76%
Chordoma	2	4.76%
Ewing's sarcoma	1	2.38%
Aneurysmal bone cyst	1	2.38%

Metastasis was the most common tumor of osseous spine.

Discussion

Backache (73.80%) and Sciatica (57.14%) were the most common clinical symptoms in this study. The other symptoms were paraparesis in 16 cases scission: paraesthesia in 7 cases and sphincter disturbances in 3 cases. Headache was present in a case of metastasis from breast carcinoma, in which the brain was also involved.

Williams MP, Cherryman GR and Husband JE in their study of 55 patients with spine tumors by MRI, found that the clinical indications for MRI included back pain (22), limb pain (6), girdle pain (2), weak legs (30), paralysis (5), urinary retention (8), and paraesthesia (5).⁷ In this study

also, similar clinical symptoms; on presentation were seen as noted in the literature.

In this study, out of 9 cases of vertebral haemangiomas, four cases were between 51 — 60 years of age groups (44.4%) and 3 cases were in 41 — 50 years of age groups. (33.3%). Four cases were located in the lumbar region (44.4%) and 3 cases were in thoracic region. (33.3%) According to Fox MW *et al.* the peak incidence of vertebral haemangiomas is in fourth to sixth decades. The lower thoracic and lumbar regions are the most common sites for vertebral haemangiomas. Lower thoracic and lumbar regions were the most common sites for vertebral haemangiomas in this study also.

According to Ross JS *et al.* vertebral haemangioma is the most common benign spinal neoplasm.⁸ This study included only cases where clinical suspicion of osseous spine tumor was present. Vertebral haemangiomas in this study were incidental findings and non-contributory to the symptoms for which they were referred. Hence less number of cases were encountered than that in the general population^[8].

Vertebral haemangiomas are round well delineated vertebral body lesions which are high signal intensity on both T1 and T2 weighted sequences. Some vertebral haemangiomas show low signal on T1 weighted images. These lesions often enhance following contrast administration^{2°}.

In this study, 8 cases out of 9 (88.9%) showed hyperintense signal on T1 weighted images. Only one case (11.1%) showed isointense signal on T1 weighted images. All cases showed hyperintense signal on T2 weighted images. Hence the imaging findings of vertebral haemangiomas in this study were, consistent with that in the literature. It is often difficult to distinguish vertebral haemangiomas from focal fatty marrow replacement. However, they are not of much importance as both are clinically indolent lesions in general^[9].

Multiple myeloma affects males more commonly. All the cases were of elderly age group. All the cases in this study were males. In this study, there were two cases of chordoma. In one case, chordoma occurred as recurrence in 65 year old male patient at L4 vertebra. When compared to previous scan, it was observed that the associated pre and: paravertebral soft tissue Component had considerably decreased. But on the second scan, there were areas of altered signal intensity in other vertebrae suggestive of metastasis. In this case, MRI was very helpful to know the progression of the disease.

Another case of chordoma, a 32 year old male, was operated in 1994 and was given radiotherapy thereafter. Presently he had complained of bilateral lower limb weakness and hence MRI was done. On MRI, heterogenous non enhancing mass lesion in the presacral region was seen as recurrent tumor. According to: Sze G *et al.* MRI is extremely useful in predicting prognosis of chordomas. Similarly it was noted in this study that MRI was very helpful to predict the prognosis of the tumor. In this study there were two cases of chondrosarcoma. One case presented with chronic backache^[10].

Conclusion

- Haemangioma is the commonest benign tumor of osseous spine in this study.
- Presence (or) absence of cord compression can be evaluated by MRI non- invasively.
- Associated findings like paraspinal soft tissue component are well depicted on MRI.

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